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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/721,164	11/26/2003	Etsuko Nakamura	2003-1698A	5528

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EXAMINER	
WALKE, AMANDA C	

ART UNIT	PAPER NUMBER
1752	

DATE MAILED: 10/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/721,164	NAKAMURA ET AL.	
	Examiner	Art Unit	
	Amanda C Walke	1752	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 May 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/26/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian et al (6,127,089) in view of Zampini et al (6,503,689).

Subramanian et al disclose a damascene structure and method of making the same in a low k dielectric material employs an imageable layer in which the damascene pattern is provided. The imageable layer is a convertible layer that upon exposure to the plasma etch that etches the low k dielectric material, converts the silicon-rich imageble layer into a mask layer containing silicon dioxide, for example. The low k dielectric material is protected from further etching by the mask thus created. In certain embodiments, the imageable layer is a silicon-rich photopolymer that includes at least 20% silicon. When exposed to the etching step that etches the first low k dielectric layer, the silicon-rich photopolymer is at least partially converted to silicon dioxide, which acts as a hard mask to protect the unexposed portions of the first low k dielectric layer. Hence, a simple oxygen plasma etch simultaneously is used in a single step to etch low k dielectric

material and convert the photopolymer to a hard mask. Since the silicon rich polymer has a very etch resistance, only a thin layer (e.g. about 250 nm) may be used as the mask layer. The converted silicon dioxide may then be serve as the mask layer. The converted silicon dioxide does not need to be stripped and can remain in place since it is a dielectric material itself. Also, since only a thin layer of the silicon rich polymer is originally deposited, the interconnect capacitance will not be greatly increased by the retention of this layer within the interconnect structure. This compares favorably with prior art structures which employ silicon dioxide layers (such as TEOS). A thin layer of a silicon-rich polymer 54 that is an aromatic based polymer, for example, is deposited on the low k dielectric layer 52. The planarizing layer typically found in a bilayer resist is not required in the present invention as the low k dielectric layer 52 serves in the capacity of a planarizing layer (commonly a BARC layer) commonly found in the bilayer resists. Instead, the silicon-rich polymer layer 54 is an imageable layer used in a bilayer resist.

While the reference teaches that the method may include a planarizing layer (taught in the background of the reference to commonly be a BARC layer), the reference fails to specifically teach the composition of that layer.

Zampini et al disclose antireflective compositions including cross-linked polymeric particles including one or more chromophores. Also disclosed are methods of forming relief images using these antireflective compositions. A wide variety of polymeric particles may be used in the present invention. Such polymeric particles may be homopolymers or copolymers, and preferably are copolymers. Thus, the polymeric particles useful in the present invention include as polymerized units one or more ethylenically or acetylenically unsaturated monomers. Preferably, the polymeric particles

include as polymerized units one or more monomers including a chromophore. As used herein, "chromophore" refers to a group that absorbs and/or attenuates the desired wavelength of the radiation used to image the photoresist. For example, when the antireflective coating compositions of the present invention are to be used with photoresists for imaging at radiation wavelengths such as 248 or 193 nm, any monomers containing as the chromophore aromatic or substituted aromatic moieties may be used. Such aromatic monomers may be used to form the uncross-linked polymer, used as the cross-linker or both. Suitable aromatic monomers include, but are not limited to, those containing phenyl, substituted phenyl, naphthyl, substituted naphthyl, anthracenyl, substituted anthracenyl, phenanthrenyl, substituted phenanthrenyl, and the like. "Substituted aromatic" refers to aromatic groups having one or more of their hydrogens replaced with one or more other substituent groups (the monomers in column 6 meet the instant structural limitations). Suitable cross-linkers useful in the present invention include di-, tri-, tetra-, or higher multi-functional ethylenically unsaturated monomers. Examples of cross-linkers useful in the present invention include, but are not limited to: trivinylbenzene, divinyltoluene, divinylpyridine, divinylnaphthalene and divinylxylene; and such as ethyleneglycol diacrylate, trimethylolpropane triacrylate, diethyleneglycol divinyl ether, trivinylcyclohexane, allyl methacrylate ("ALMA"), ethyleneglycol dimethacrylate ("EGDMA"), diethyleneglycol dimethacrylate ("DEGDMA"), propyleneglycol dimethacrylate, propyleneglycol diacrylate, trimethylolpropane trimethacrylate ("TMPTMA"), divinyl benzene ("DVB"), glycidyl methacrylate, 2,2-dimethylpropane 1,3 diacrylate, 1,3-butylene glycol diacrylate, 1,3-butylene glycol dimethacrylate, 1,4-butanediol diacrylate, diethylene glycol diacrylate, diethylene glycol

dimethacrylate, 1,6-hexanediol diacrylate, 1,6-hexanediol dimethacrylate, tripropylene glycol diacrylate, triethylene glycol dimethacrylate, tetraethylene glycol diacrylate, polyethylene glycol 200 diacrylate, tetraethylene glycol dimethacrylate, polyethylene glycol dimethacrylate, ethoxylated bisphenol A diacrylate, ethoxylated bisphenol A dimethacrylate, polyethylene glycol 600 dimethacrylate, poly(butanediol)diacrylate, pentaerythritol triacrylate, trimethylolpropane triethoxy triacrylate, glyceryl propoxy triacrylate, pentaerythritol tetraacrylate, pentaerythritol tetramethacrylate, dipentaerythritol monohydroxypentaacrylate, divinyl silane, trivinyl silane, dimethyl divinyl silane, divinyl methyl silane, methyl trivinyl silane, diphenyl divinyl silane, divinyl phenyl silane, trivinyl phenyl silane, divinyl methyl phenyl silane, tetravinyl silane, dimethyl vinyl disiloxane, poly(methyl vinyl siloxane), poly(vinyl hydro siloxane), poly(phenyl vinyl siloxane) and mixtures thereof. The cross-linking catalysts useful in the present invention are typically acids, photoacid generators, photobase generators or mixtures of acids and photoacid generators. It is preferred that the catalyst is an acid, photoacid generator or mixture thereof. Suitable acids include organic acids such as sulfonic acids. Aromatic sulfonic acids such as phenylsulfonic acid and para-toluenesulfonic acid are particularly suitable. More than one cross-linking catalyst may be advantageously used in the present invention. The photoacid generators useful in the present invention are any compounds which liberate acid upon exposure to light, typically at a wavelength of about 320 to 420 nanometers, however other wavelengths may be suitable. Suitable photoacid generators include halogenated triazines, onium salts, sulfonated esters, halogenated sulfonyloxy dicarboximides, diazodisulfones, .alpha.-cyanooxyaminesulfonates, imidesulfonates, ketodiazosulfones, sulfonyldiazoesters, 1,2-

di(arylsulfonyl)hydrazines and the like. Optional additives that may be used in the photoresist compositions of the present invention include, but are not limited to: anti-striation agents, plasticizers, speed enhancers, fillers, dyes, film forming agents, cross-linking agents and the like. Such optional additives will be present in relatively minor concentrations in a photoresist composition except for fillers and dyes which may be used in relatively large concentrations, e.g. in amounts of from about 5 to 30 percent by weight, based on the total weight of the composition's dry components. The use of the ARC layer of the reference provides better planarization.

Given the teachings of the references, it would have been obvious to one of ordinary skill in the art to prepare the material of Subramanian et al choosing to employ the layer of Zampini et al as the planarizing layer to increase the planariztion, with reasonable expectation of achieving a material forming an accurate pattern.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yim (6,080,678), Lee et al (6,569,599), Early et al (6,232,002 and 6,352,930), and Tao et al (6,037,266) are cited for their teachings of similar materials and methods.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amanda C Walke whose telephone number is 571-272-1337. The examiner can normally be reached on M-R 5:30-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Amanda C Walke
Examiner
Art Unit 1752

ACW
September 17, 2004